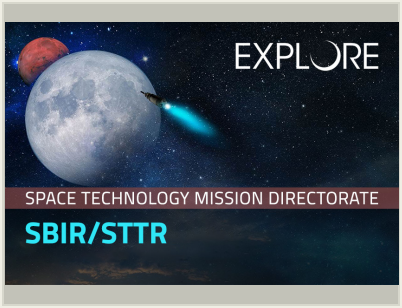
LunarCube for Deep Space Missions, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

Busek Co., Inc. and Morehead State University propose to develop a 6U CubeSat capable of reaching a lunar orbit from GEO. The primary objective is to demonstrate heretofore unavailable high Isp(~3000s) with a small and very efficient ion thruster. A mission to the moon will demonstrate a propulsion technology that enables a variety of other deep space missions. Unlike the well-known and much larger DC ion thrusters flown on missions such as Deep Space 1 and Dawn, the proposed thruster is powered by an inductively coupled RF discharge with condensable propellant. The chosen propellant is stored as a high-density solid at room temperature with minimal vapor pressure. Such property enables the storage tank to be small, lightweight and moldable for maximizing propellant volume. These benefits are further realized by the use of Busek's miniature RF ion thruster (RFIT) system. Busek's ion thrusters were developed to answer the need for a small yet high-performance EP device, as their DC counterparts are difficult to scale down and achieve long life due to the internal cathode. The BRFIT-3 thruster proposed for the LunarCube has a 3cm grid diameter, is close to 50% efficient and delivers variable Isp and thrust of ~3000s and ~2mN, respectively. With this performance, <0.8kg of propellant can sufficiently provide delta V >3km/s. The thruster's life by estimation is in excess of 20,000 hours. An additional objective is to demonstrate that much of the spacecraft electronics, primarily the C&DH portion, can be based on low-cost components and survive the deep space environment. The mission will also require pioneering approaches to ADCS and power generation. Initial design of the solar arrays includes two winged panels mounted on Honeybee Robotics' gimbals, and together they will deliver peak power of ~96W. One option for the payload will be a miniature long wavelength IR camera made by Malin Space Science Systems that could be used for geological studies.



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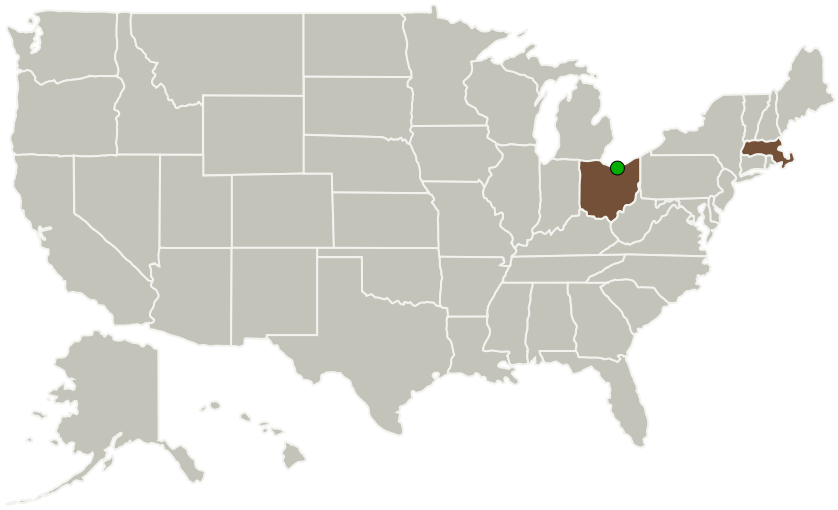
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Busek Company, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Natick, Massachusetts
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Massachusetts	Ohio

Project Transitions

June 2014: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Busek Company, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Kurt Hohman

Co-Investigator:

Kurt Hohman

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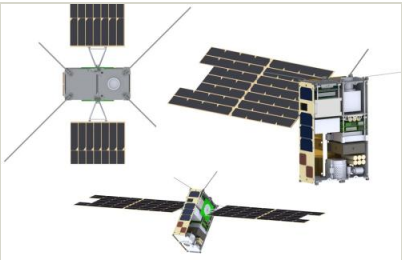
December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140617)*

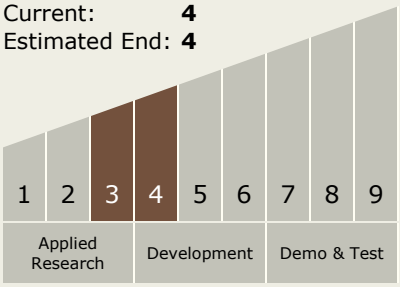
Images



Briefing Chart
LunarCube for Deep Space Missions, Phase I
(https://techport.nasa.gov/image/135580)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System